



Executive Summary

National Photographic Interpretation Center



Pathfinder: Identifying Critical Exploitation Tools for Insertion Now



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This report was prepared in the National Exploitation Laboratory (NEL) of the National Photographic Interpretation Center (NPIC) on behalf of the Central Imagery Office (CIO). For additional information, including a Pathfinder briefing with annotated comments, see the Pathfinder section of the Technology Infusion for the Exploitation Initiative page located on the NPIC homepage on Intelink. (<http://www.npic.ic.gov/npic/nel/techinfusion.html>).

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Pathfinder: Identifying Critical Exploitation Tools for Insertion Now

Foreword

Imagery exploitation research and development has yielded tools and technologies that can enhance imagery analyst (IA) efficiency and improve support to customers. Some of these tools and technologies are available now.

Further, there is clear recognition in the intelligence, operational, and Congressional communities that emphasis on exploitation-related tools and insertion of technology into imagery exploitation day-to-day operations is overdue.¹ Without progress here, imagery analysts will be exploiting tomorrow's imagery with yesterday's technology.

Last year Project Beacon and the Exploitation Process Reengineering Study prioritized selected technology areas most needed and established a model for exploitation at the turn of the century. This year Project Pathfinder launched a drive to bring needed technologies to IAs as soon as practical. Such improvements in IA environments have the potential to lead to more relevant and timely imagery products and services to consumers.

The Pathfinder process, with its focus on IA environments and user-developer interaction, acts as a catalyst to push the transfer of critical exploitation technologies "out of the lab and into imagery exploitation organizations."

¹See, for example, the Executive Summaries of the annual Exploitation Technology Symposium (TCS-19033/94, July 1994; TCS-19062/95, December 1995.)

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**Pathfinder: Identifying
Critical Exploitation Tools
for Insertion Now**

Objective

Pathfinder is a key part of the Central Imagery Office’s (CIO’s) Exploitation Initiative and one of several activities aimed at improving imagery exploitation to provide enhanced, timely imagery support to users. It grew out of the National Photographic Interpretation Center’s (NPIC’s) National Exploitation Laboratory (NEL) Project Beacon and the CIO’s Exploitation Process Reengineering Study (ExPReS).

Pathfinder’s goal is to introduce improvements into the imagery analyst (IA) environment in the near term. It takes advantage of user involvement to help developers and exploitation organizations focus on expediting the fielding of new or improved tools and technologies. By providing new tools to IAs now, we can better understand the future potential for providing improved products and services in a softcopy environment. Pathfinder 96 objectives were to develop specific recommendations for infusing imagery exploitation tools into IA environments, and to ensure that those recommendations included potential improvements to the analysis process and customer support. Pathfinder 96 was conducted from July to December 1995.

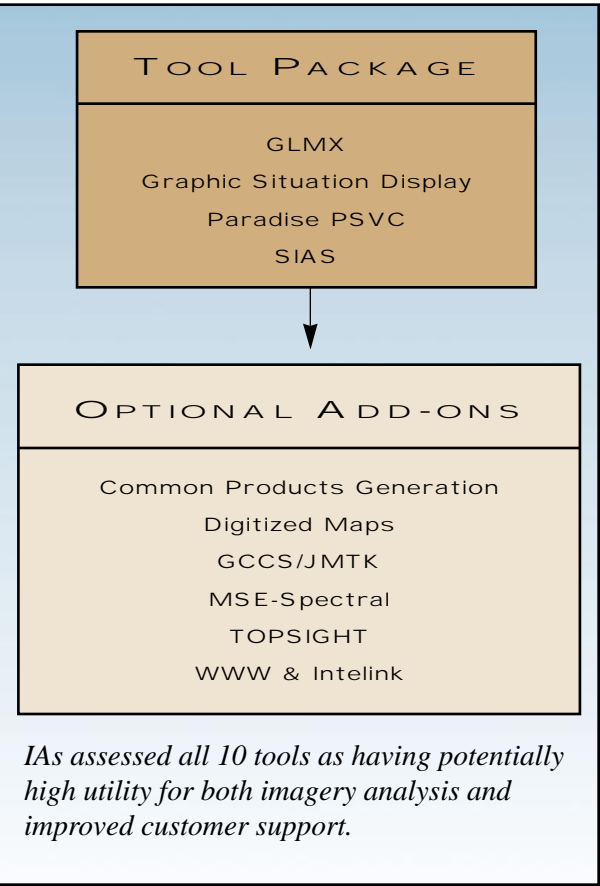
Overview

Pathfinder 96 focused on needed exploitation tools mature enough to be inserted into IA environments in fiscal years 1996-1998. These tools became known as “Low Hanging Fruit” or LHF, an analogy to fruit that is ripe, able to be plucked, and ready for consumption.

Fifty-five candidate LHF, spanning 14 technology areas, were considered in the Pathfinder 96 process.² Eleven IAs from six imagery exploitation organizations, with developer and program office support, assessed the 55 LHF for their potential to improve the exploitation process and customer satisfaction. At the conclusion of the Pathfinder process, 10 tools were recommended for fiscal year 1996 insertion (figure 1)—four tools, considered in a tool package, and six as optional add-ons.

² See Appendix A for additional summary information.

Figure 1. Recommendations³

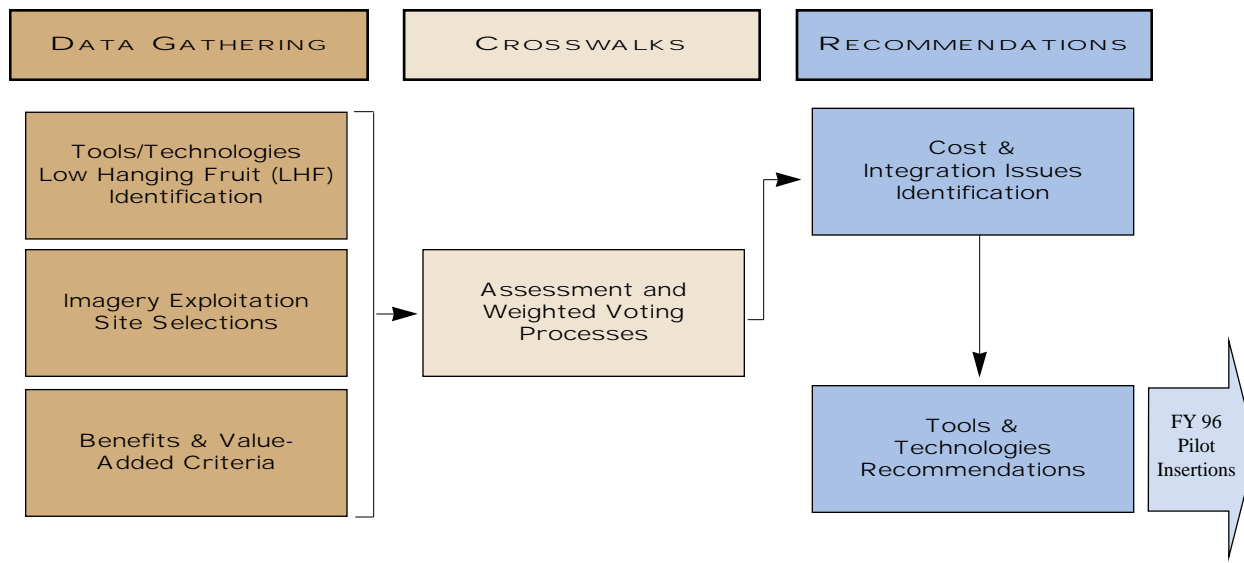


Process

The Pathfinder 96 process (figure 2) included data gathering, crosswalks, and recommendations. Participation and open and sustained communication between developer and program offices on the one hand and imagery exploitation and mapping organizations on the other was critical to process execution and success.

³ See Appendix B for full titles and brief descriptions of the 10 recommendations.

Figure 2. Pathfinder Process



Data Gathering

Tools/Technologies (LHF) Identification

Government research and development organizations, program offices, and imagery exploitation and mapping organizations were invited to participate and asked to provide LHF submissions to the Pathfinder 96 process. Taking advantage of a variety of imagery community meetings and briefings (the Exploitation Technology Symposium, 1995, for example) and seeking input on Intelink, the Pathfinder team used a variety of venues for input. In all, 55 candidate submissions were received.

Imagery Exploitation Site Selections

Six imagery exploitation sites were selected mainly because of their already established participation in the CIO's Pilot Accelerated Architecture Acquisition Initiative (PA3I). The XVIII Airborne Corps was the only non-PA3I site. The six sites sent IAs as subject matter experts to participate in the crosswalks activities and provide some technical information about their sites. The technical information provided context to help understand how the LHF might operate in day-to-day imagery exploitation. The six participating sites were:

- XVIII Airborne Corps (ABC).
- Atlantic Command (ACOM).
- Central Command (CENTCOM).
- Defense Intelligence Agency (DIA).
- National Ground Intelligence Center (NGIC/TAC-D).
- National Photographic Interpretation Center (NPIC).

Benefits and Value-Added Criteria

The NEL developed assessment criteria to judge the potential utility of each LHF. The criteria dealt with qualitative and quantitative improvements the tool potentially could make *first* to the exploitation process and *second* to customer satisfaction. The four criteria were:

- Improved timeliness.
- Enhanced quality.
- Increased throughput.
- Greater flexibility.

To facilitate the assessments of improvements to imagery exploitation, exploitation was considered in terms of seven component subprocesses, which were identified during the Beacon study⁴ and which aligned with the imagery exploitation process defined in the ExPREs. These were:

- Obtain imagery.
- Obtain reference material.
- Set up work area.
- Build context.
- Perform cognitive analysis.
- Manipulate the data.
- Come to closure.

⁴See the Beacon section of the Technology Infusion for the Exploitation Initiative page located on the NPIC homepage on Intelink. (<http://www.npic.ic.gov/npic/nel/techinfusion.html>).

The IAs used the four criteria to assess the benefits of the LHF to the seven exploitation subprocesses. The four criteria also were used to assess potential benefits to customer satisfaction. For the customer satisfaction assessment, four broad customer groupings were included: analysts, policymakers, planners, and warfighters. The category of analysts included IAs, all-source intelligence analysts, and target analysts. Policymakers were considered to be those who make and execute US national policy. Planners included those who plan overt or covert operations, including military and nonmilitary (such as, emergency flood relief). Warfighters included those who carry out military operations. Participants judged the effect of each LHF on the timeliness, quality, throughput, and flexibility of support to each of the four customer groups.

Crosswalks

Eleven experienced IAs from the six exploitation sites gathered for three and a half days to assess the LHF using the benefits and value-added criteria. All of the IAs had at least eight years of experience in imagery exploitation; three had more than 20 years.

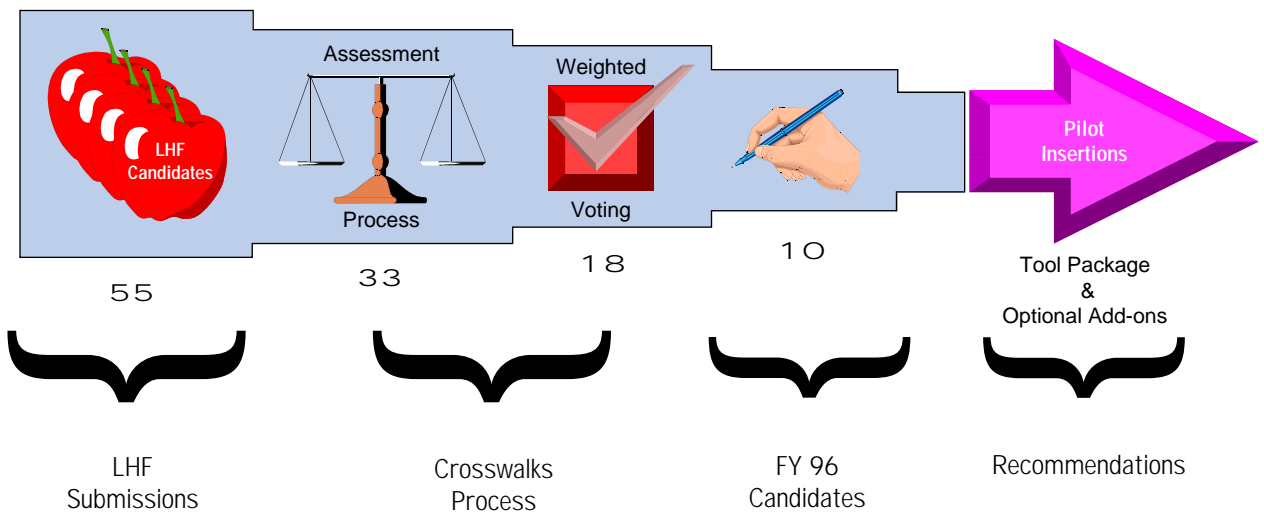
To assist the IAs in understanding the capabilities and functions of each LHF, textual information was provided, including functional and technical descriptions.

In addition, government sponsors’ representatives provided short briefings on the tools. The review and discussions focused on tool functional capabilities and user interactions. This established a good foundation for tool understanding. The IAs assessed each tool *first* for potential improvements to the exploitation process and *second* for its potential to improve customer support.

All 55 tools were subjected to this process. Using the information gathered, the group reviewed the results and reached consensus about which tools appeared to offer the most potential. Thirty-three were so identified. Some of the 33 were perceived to provide greatly increased utility across the exploitation process. Others were niche tools focused either on one of the exploitation subprocesses or a specific customer need.

The IAs further refined the selections by consensus discussions and voting to determine which of the 33 tools they would want first. To facilitate the process, each exploitation organization was provided 10 votes to use however they desired, such as, one vote for 10 tools or more votes for fewer tools. Consensus was reached on 18 of the 33 tools, available in fiscal years 1996-1998. Figure 3 depicts the flow of the down-select process.

Figure 3. Down-Select Process



Recommendations

The crosswalks yielded 18 tool candidates available in fiscal years 1996-1998. CIO requested that only fiscal year 1996 tools be considered in order to focus the final recommendations. Therefore, the 10 tools identified as available in fiscal year 1996 were the only ones considered in the final recommendations. CIO also provided guidance on general resource considerations, because inserting all 10 tools would exceed available resources. In the end, all 10 tools were included in the recommendations, with four being identified as an initial package and the other six as recommended add-ons should additional resources become available (figure 1). Overall, these recommendations were based on:

- Information gleaned from the IAs during the crosswalks as to how the tools could improve their exploitation environments and provide better customer support.
- Analysis of the tools, which yielded certain groupings that would provide a suite that could support imagery exploitation from the national to the tactical levels.
- A focus on fiscal year 1996 and an estimation of the expected available resources.

Conclusion

Operational use of the recommended tools in actual exploitation environments, backed up by user and technical assessments in the field, will determine if further

insertion of the capabilities is warranted. Imagery exploitation organizations should recognize that it was largely the available resources that brought the focus on four of the 10 recommended tools. The tools identified as optional add-ons, as well as the other tools considered in the total Pathfinder process, should by no means be excluded from further consideration for improving the imagery exploitation process or customer support.⁵

The Pathfinder process, with its focus on IA environments and user-developer interaction, acts as a catalyst to push the transfer of critical exploitation technologies “out of the lab and into imagery exploitation organizations.” For Pathfinder 96, the process identified and recommended tools to be considered for insertion to potentially improve imagery analysis and customer support.

In the larger sense, the Pathfinder process performs an important bridging function to help move tools and technologies from the R&D communities into the operational imagery exploitation communities.

⁵ For an annotated briefing covering the entire Pathfinder 96 process from July through December 1995, see the Pathfinder section of the Technology Infusion for the Exploitation Initiative page located on the NPIC homepage on Intelink. (<http://www.npic.ic.gov/npic/nel/techinfusion.html>).

Appendix A

Technology Candidate Submissions

Figure A-1 provides a listing of the technology areas and the 55 tool submissions within those areas. While two technology areas received no tool candidate submissions, this does not imply that there may not be any tools in these areas. The tools needed to be operationally insertable in the fiscal years 1996-1998 in order to be Pathfinder candidates.

The request for submissions was broadcast to the imagery community (government program and development offices and exploitation organizations) through briefings and presentations at various meetings including the Exploitation Technology Symposium, 1995, and Pathfinder meetings to which members of groups such as the Exploitation Research and Development (EXRAND) group and the Imagery Research and Development (IMRAD) Council were invited. Information about Pathfinder, including requests for tool submissions, also was available on Intelink.

Figure A-1 is taken from the graphics used during the final presentation to the Central Imagery Office in December 1995. More detailed data is available on all

of these submissions in the Pathfinder section of the Technology Infusion for the Exploitation Initiative page located on the NPIC homepage on Intelink, or you may contact Susan Kalweit, NPIC/NEL, (202) 863-3305. (<http://www.npic.ic.gov/npic/nel/techinfusion.html>).

Figure A-1. Submissions

Technology Area	Number of Tools
GIS Capabilities	12
Collaboration	2
Site Models	5
Mosaicking	1
Digital Environment	3
Data Fusion	3
ATD/ATC	9
Advanced Displays	1
Data Access	0
Automated Reporting	0
Image-Image Registration	4
Artificial Intelligence	1
Radio/Thermometric Tools	1
Imagery Manipulation Tools	7
Training Tools	1
Imagery Production Tools	5

Appendix B

Recommendations

Provided below are the names and an associated short description of the 10 tools recommended to the Central Imagery Office for consideration for fiscal year 1996 insertion.

Tool Package

- **Geolocated Multi-Source Exploitation Three-Dimension Site Model Builder (GLMX):** Creates georegistered three-dimensional site models using digital imagery. Creates two-dimensional and three-dimensional site views and renders three-dimensional views in different perspectives or as overlays “draped” on digital terrain information.
- **Graphic Situation Display (GSD):** Provides a flexible, georegistered graphic reporting capability—an “electronic grease board”—when used in conjunction with a map or image viewing application. Provides the IA with a rapid, standard means of depicting and transmitting situation information and military symbols on imagery or map (raster or vector) background.
- **Paradise PSVC:** Supports collaborative imagery analysis among various exploitation organizations. Permits the IAs to teleconference simultaneously with video and audio, share white board capabilities, and interactively annotate (each with a unique color) a displayed image on the white board.
- **Spatial Image Annotation System (SIAS):** Provides the IA with the capability of making annotations or target overlays. Allows the IA to create simple to complex annotated facility and installation outlines which are georegistered in three dimensions. Readily displays overlays and outlines on new images from the same or other sensors.

Optional Add-ons

- **Common Products Generation (CPG):** Provides the capability to generate standardized multi-spectral imagery (MSI)-derived products rapidly and accurately. Allows the IA to create one or more of eight standard products from commercially available MSI. Supports a user-friendly method of interaction with several selectable skill levels.

- **Digitized Maps:** When used in conjunction with a commercially available GIS, provides access to the Defense Mapping Agency’s (DMA) Map Library program including ARC Digitized Raster Graphics, Digital Chart of the World, Digital Nautical Chart, and Vector Smart Maps. Provides the IA with access to digital mapping data, as well as periodic DMA updates.
- **Global Command and Control System/Joint Mapping Toolkit (GCCS/JMTK):** Provides for the display and manipulation of mapping and charting data for the emerging world-wide military command and control system. Permits the IA to use the capabilities and to provide customized map products within the military command and control system.
- **Model Supported Exploitation (MSE)-Spectral Collaboration/ Presentation Tool:** Provides a collaborative method of producing and presenting a multi-sensor/multi-process model analysis using an extension of hypertext. Permits analysts from different backgrounds to fuse their information and conclusions for broader understanding and in-depth analysis.
- **TOPSIGHT: Automatic Target Detection/Cueing (ATD/ATC):** Rapidly focuses IA attention to image areas with target activity. Uses radar imagery and context-based force models to highlight field-deployed military units. Provides the IA with prioritized information about which images should be exploited first and then focuses attention on likely target areas on an image selected by an IA.
- **World Wide Web (WWW) and Intelink Site Model Visualization Tool:** Provides a capability to access and interactively visualize three-dimensional, IPT-rendered site models using Intelink. Permits the IA to access existing site models and collateral associated information to support imagery analysis. Supports production of visualization products for users.

More detailed data is available on these submissions. See the Pathfinder section of the Technology Infusion for the Exploitation Initiative page located on the NPIC homepage on Intelink or you may contact Susan Kalweit, NPIC/NEL, (202) 863-3305. (<http://www.npic.ic.gov/npic/nel/techinfusion.html>).